This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

FIG.1

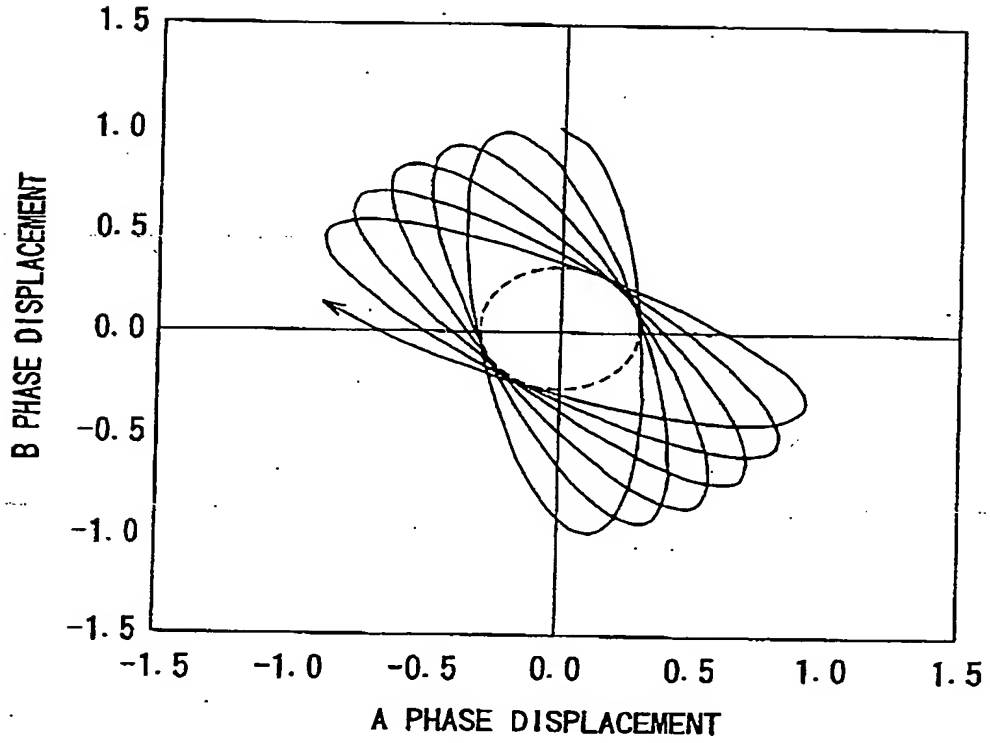

1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
B PHASE DISPLACEMENT
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
A PHASE DISPLACEMENT

FIG.2

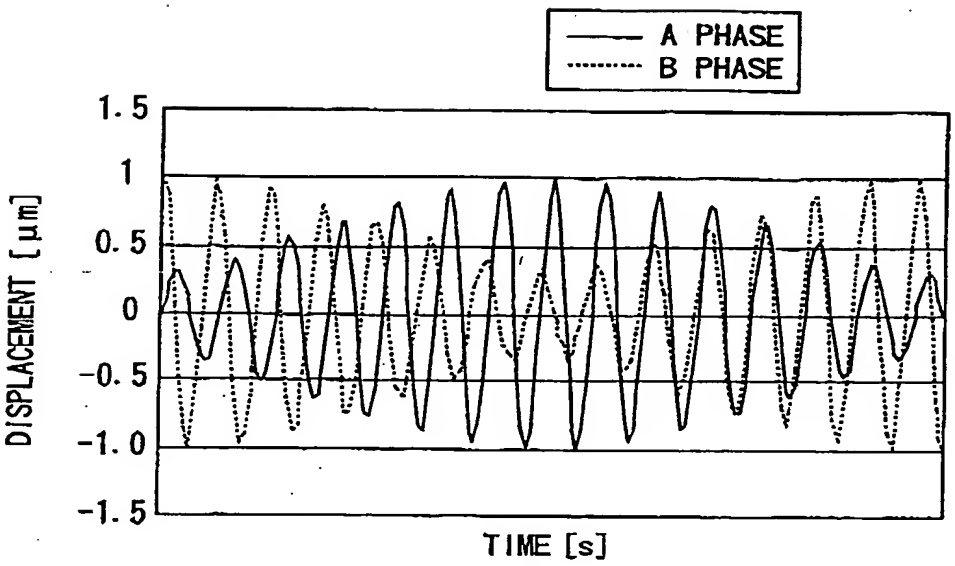


FIG.3

$A=(V+a)\cos\alpha\cos\omega t-V\sin\alpha\sin\omega t$

$B=(V+a)\sin\alpha\cos\omega t+V\cos\alpha\sin\omega t$

A:A PHASE DRIVING VOLTAGE, B:B PHASE DRIVING VOLTAGE,
V:DRIVING VOLTAGE(FUNDAMENTAL VOLTAGE), a:STANDING WAVE AMPLITUDE,
α:TURNING ANGLE, ω:DRIVING ANGULAR VELOCITY

FIG.4A

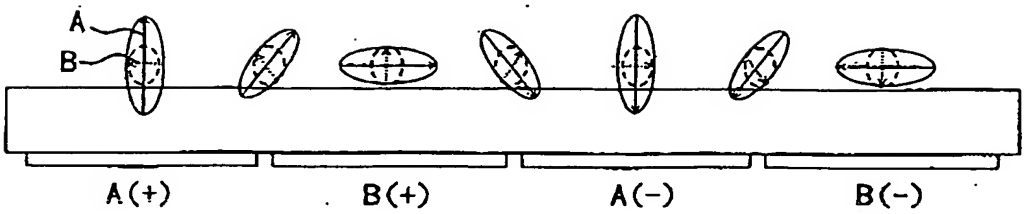


FIG.4B

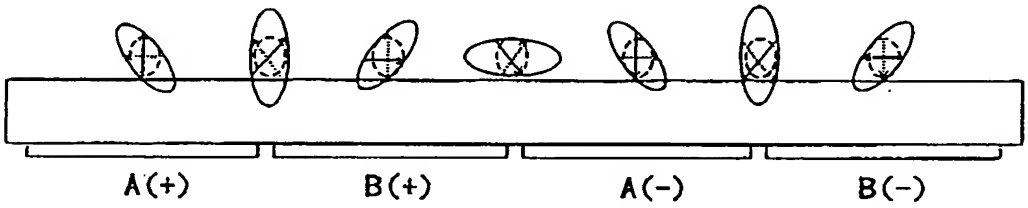


FIG.4C

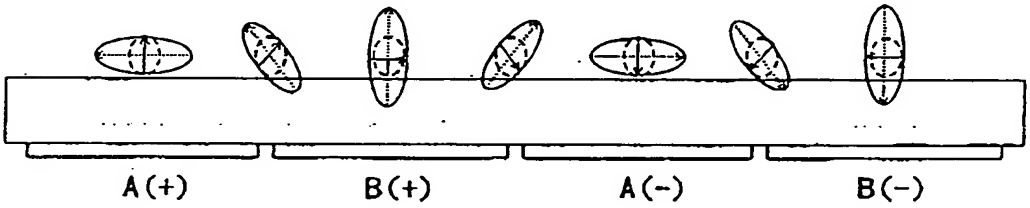


FIG.4D

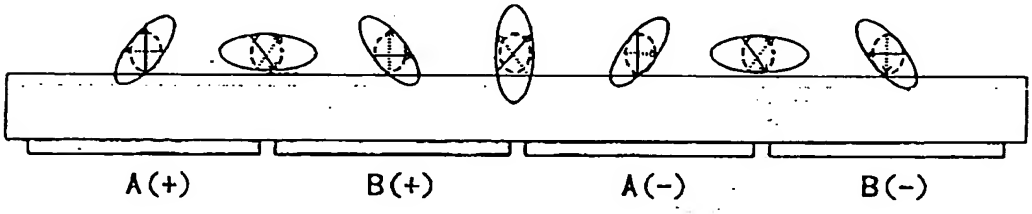


FIG.5

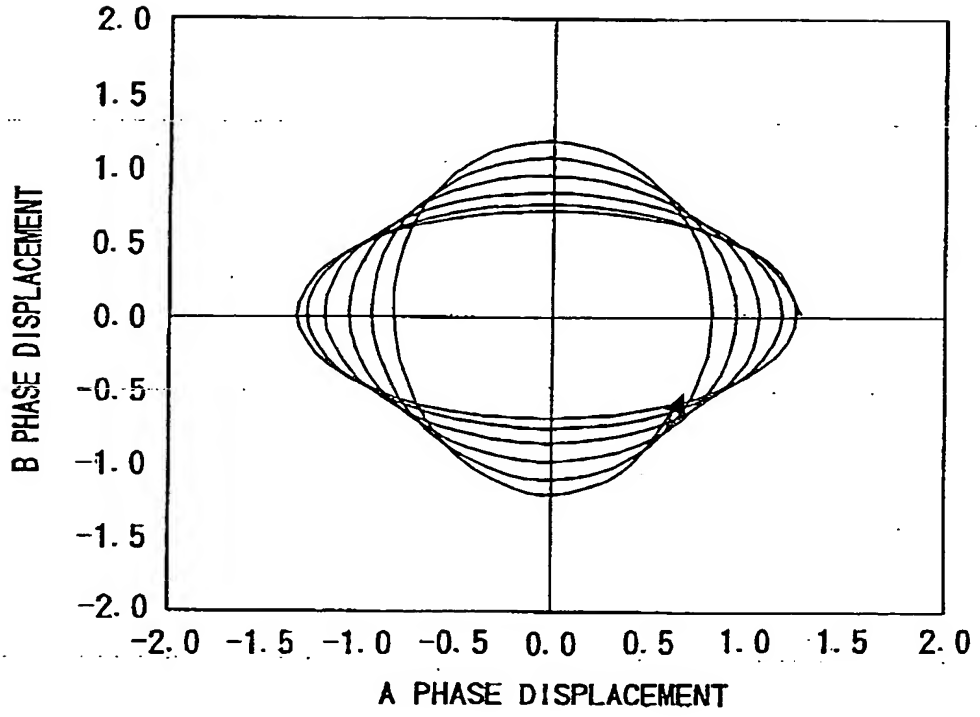

2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
B PHASE DISPLACEMENT
-2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0
A PHASE DISPLACEMENT

FIG.6

$A=(V+a\cos\phi)\cos\omega t$
$B=(V-a\cos\phi)\sin\omega t$
A:A PHASE DRIVING VOLTAGE, B:B PHASE DRIVING VOLTAGE,
a:MODULATION AMPLITUDE, ϕ:MODULATION PHASE,
ω:DRIVING ANGULAR VELOCITY,
V:DRIVING VOLTAGE(FUNDAMENTAL VOLTAGE)

FIG.7

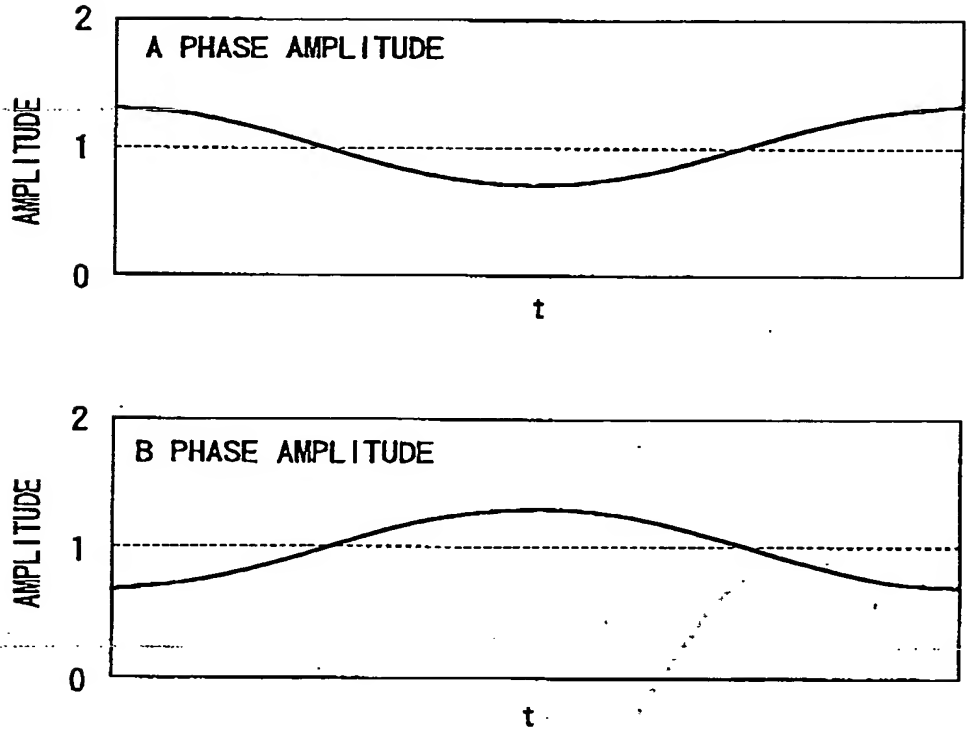


FIG.8

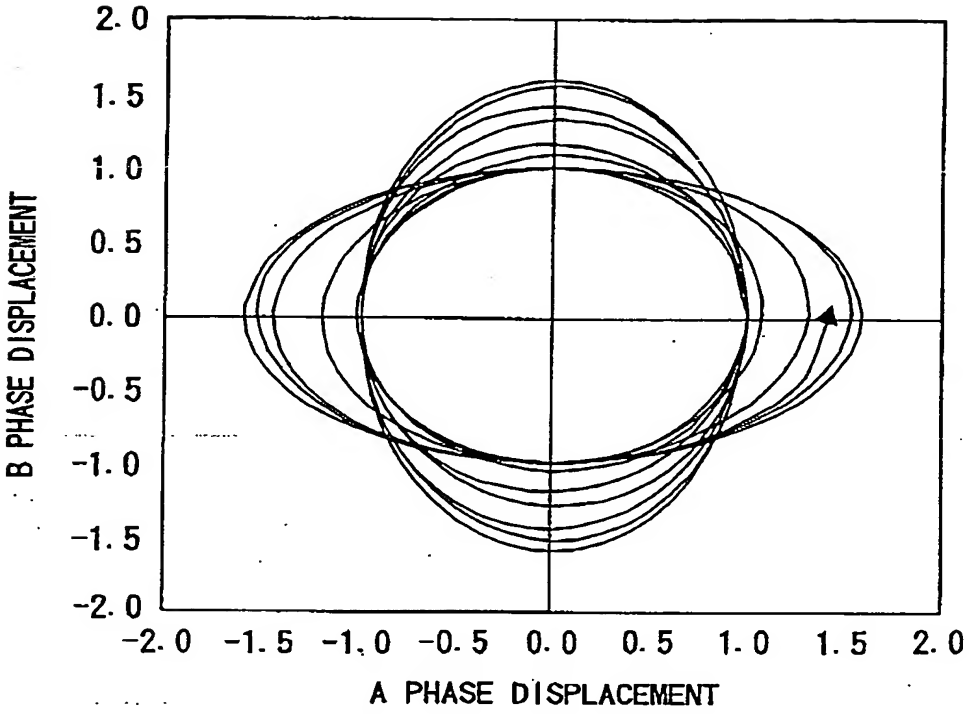

2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
B PHASE DISPLACEMENT
-2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0
A PHASE DISPLACEMENT

FIG.9

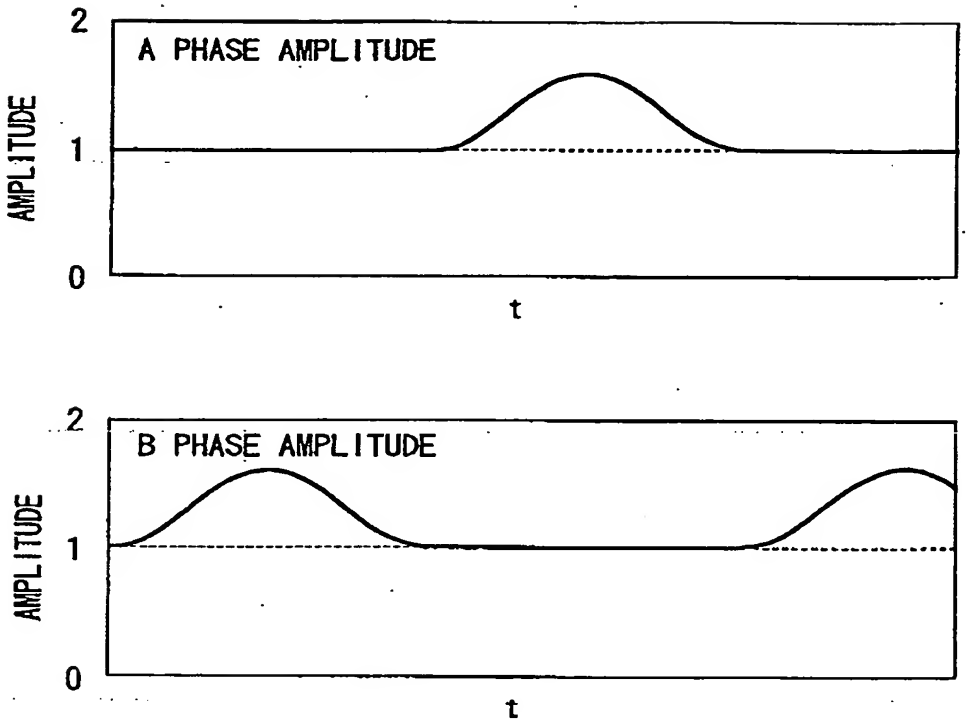

2
A PHASE AMPLITUDE
AMPLITUDE
1
0
t
2
B PHASE AMPLITUDE
AMPLITUDE
1
0
t

FIG.10

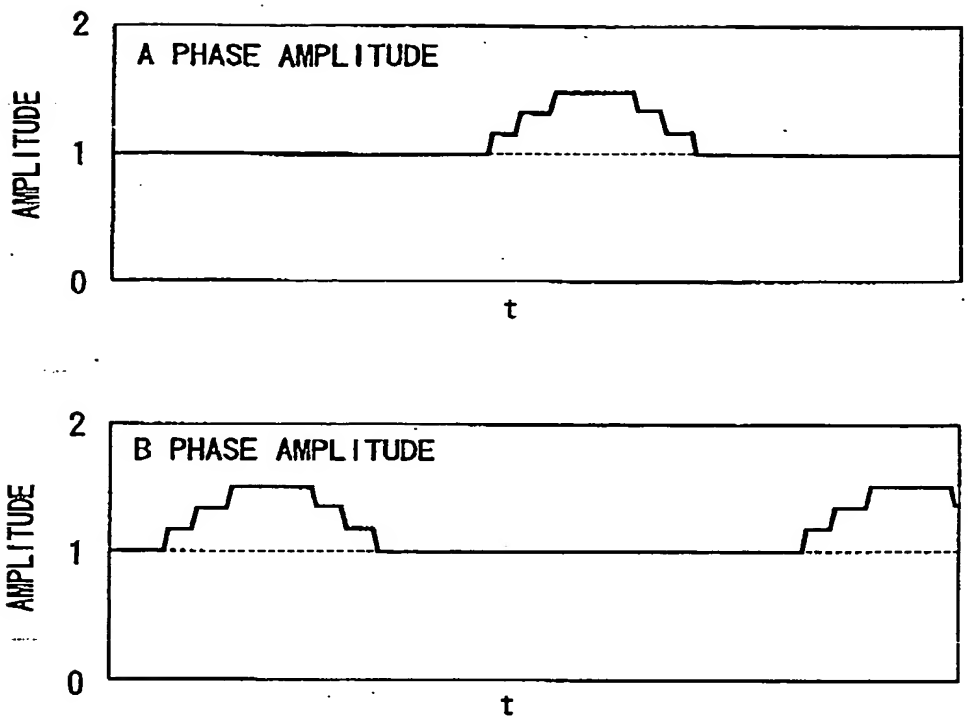
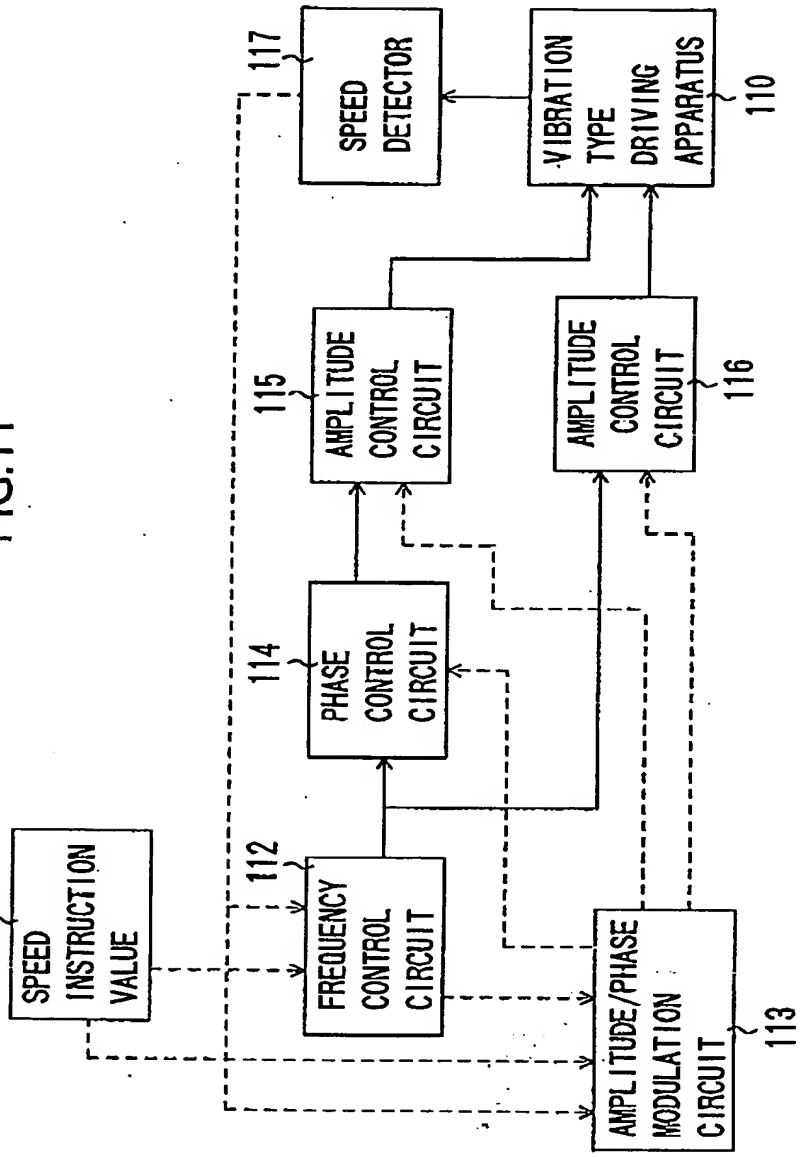

A PHASE AMPLITUDE
AMPLITUDE
2
1
0
t
B PHASE AMPLITUDE
AMPLITUDE
2
1
0
t

FIG.11


SPEED INSTRUCTION VALUE
111
FREQUENCY CONTROL CIRCUIT
112
AMPLITUDE/PHASE MODULATION CIRCUIT
113
PHASE CONTROL CIRCUIT
114
AMPLITUDE CONTROL CIRCUIT
115
AMPLITUDE CONTROL CIRCUIT
116
SPEED DETECTOR
117
VIBRATION TYPE DRIVING APPARATUS
110

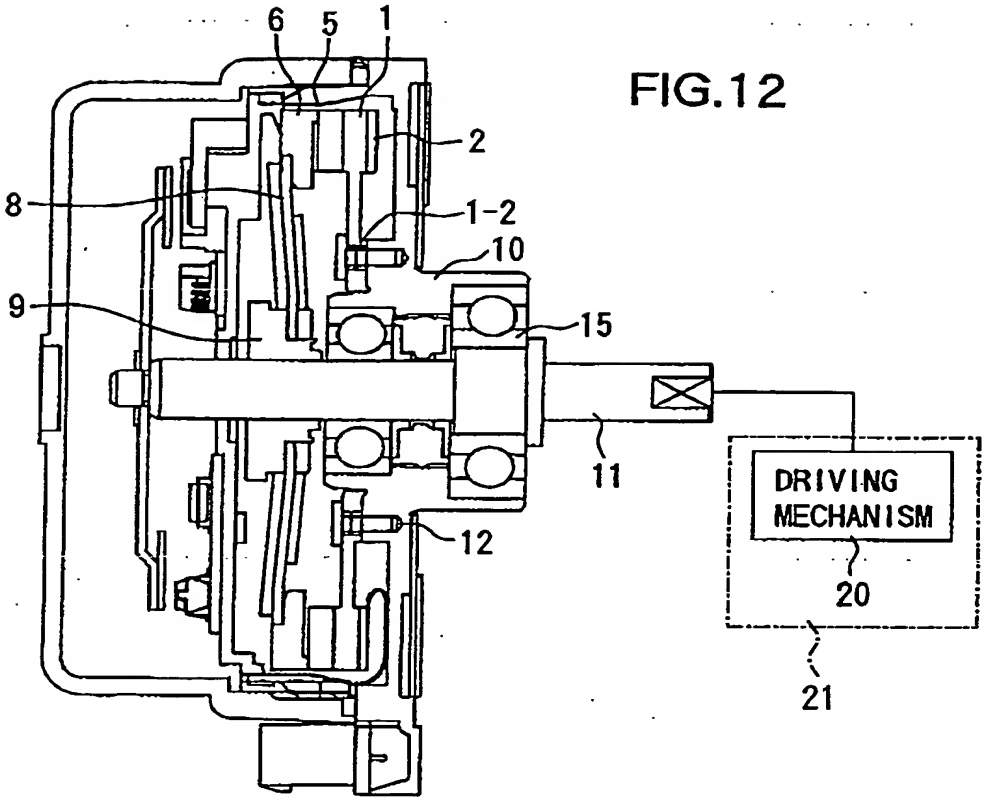
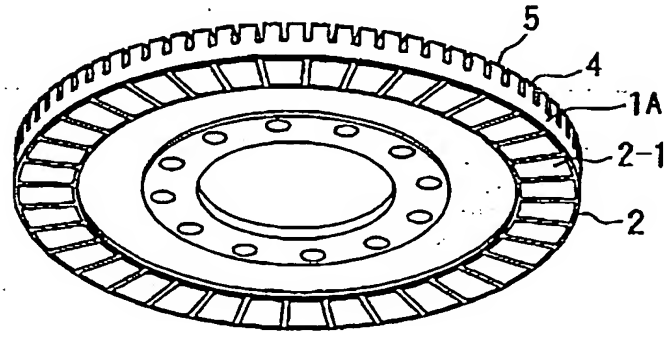


FIG.12

FIG.13



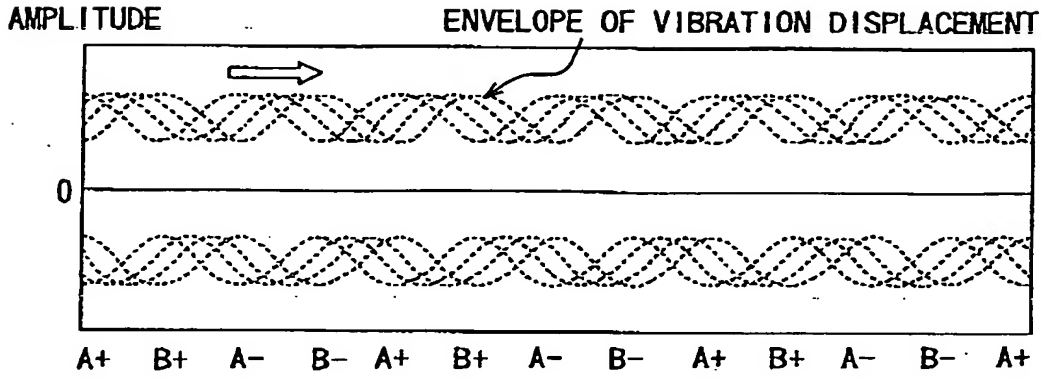


FIG.14

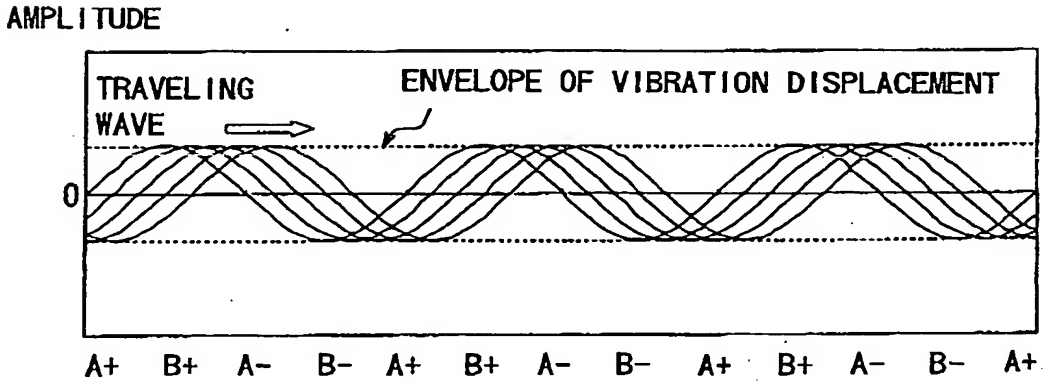


FIG.15
(PRIOR ART)

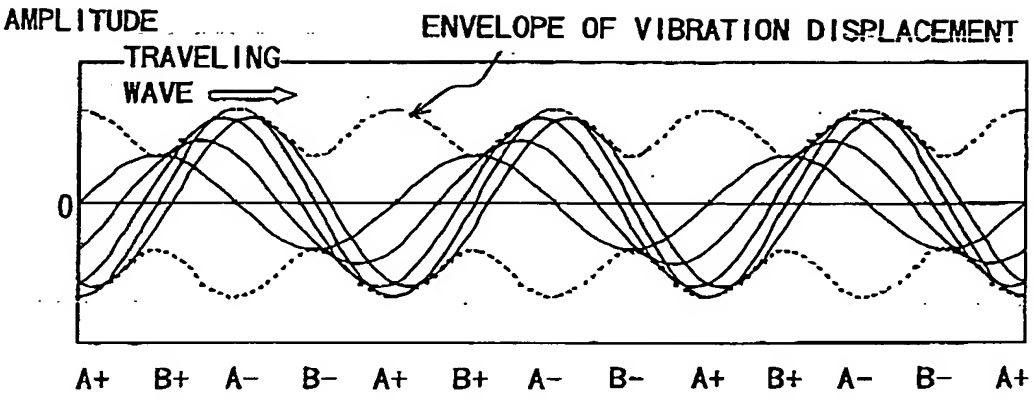


FIG.16
(PRIOR ART)

FIG.17

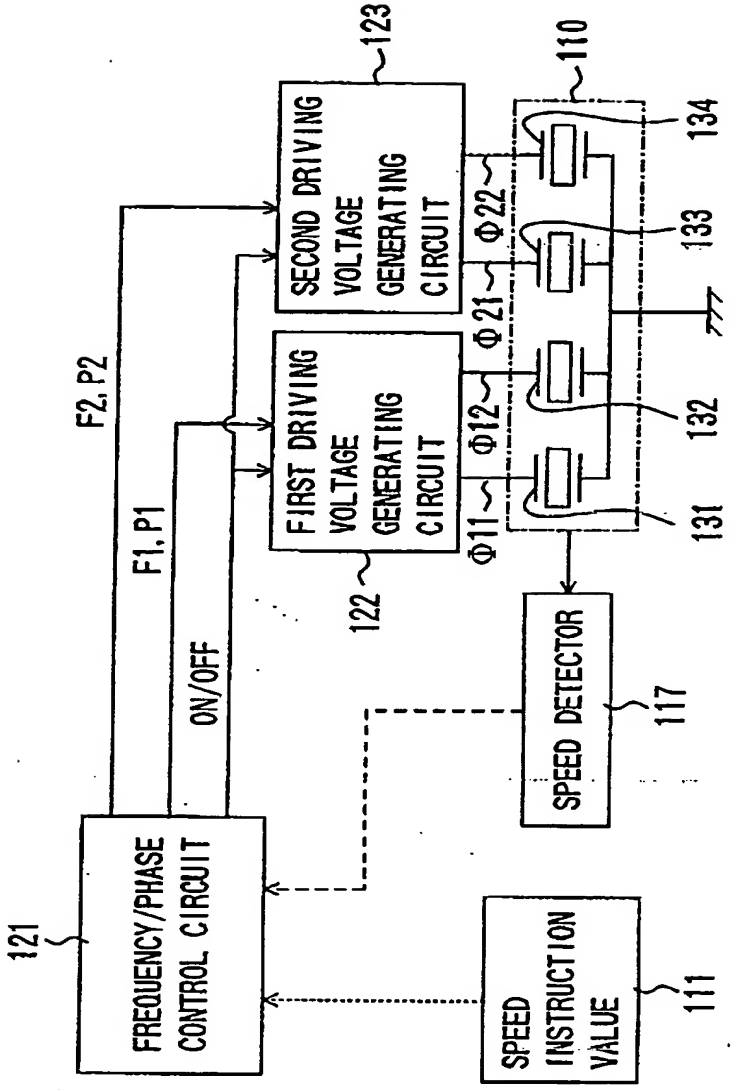

121
FREQUENCY/PHASE CONTROL CIRCUIT
111
SPEED INSTRUCTION VALUE
F1, P1
F2, P2
ON/OFF
122
FIRST DRIVING VOLTAGE GENERATING CIRCUIT
123
SECOND DRIVING VOLTAGE GENERATING CIRCUIT
Φ11
Φ12
Φ21
Φ22
110
131
132
133
134
117
SPEED DETECTOR

FIG.18

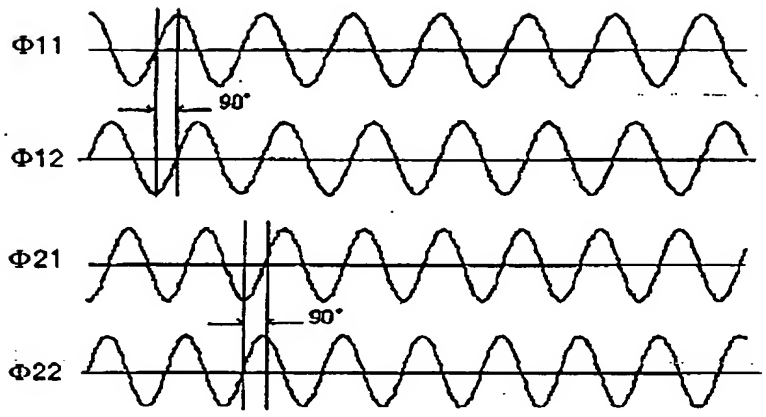


FIG.19

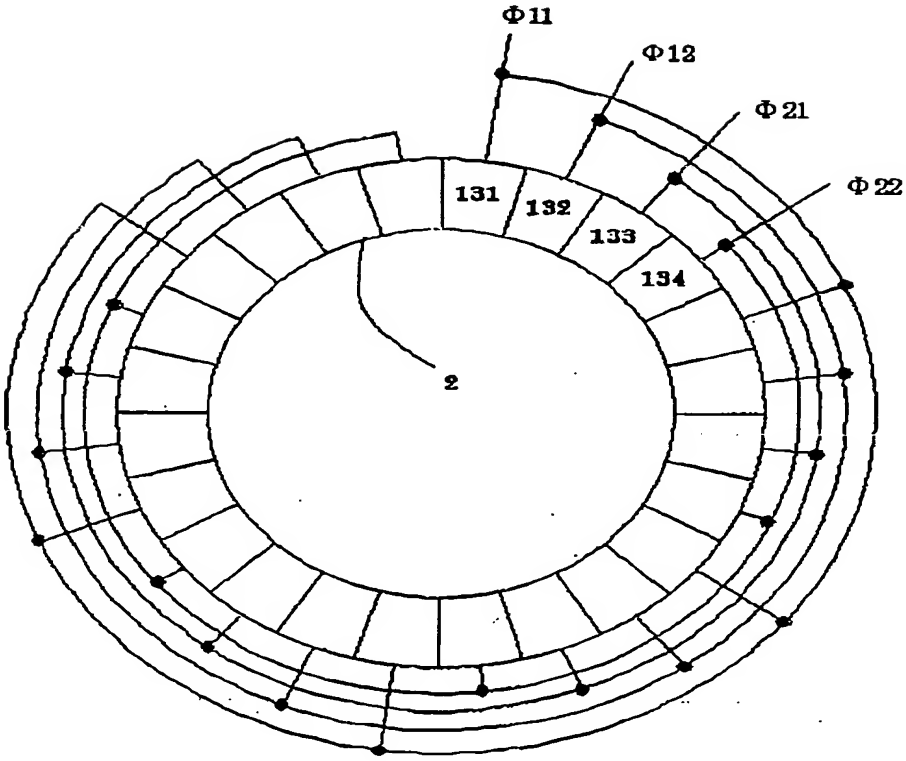


FIG.20

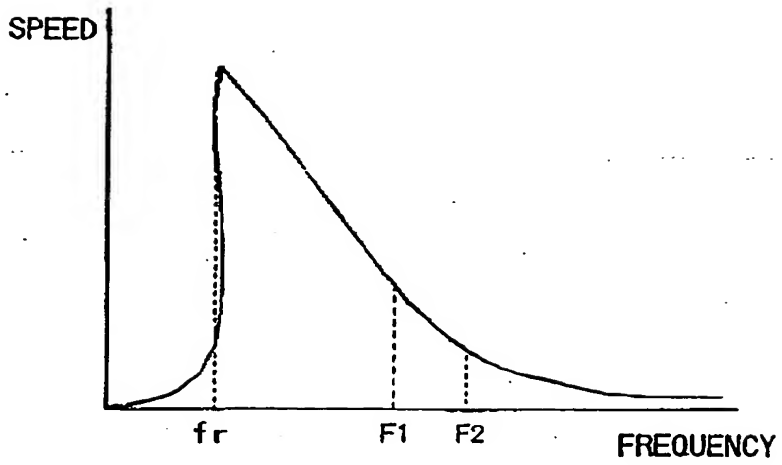


FIG.21

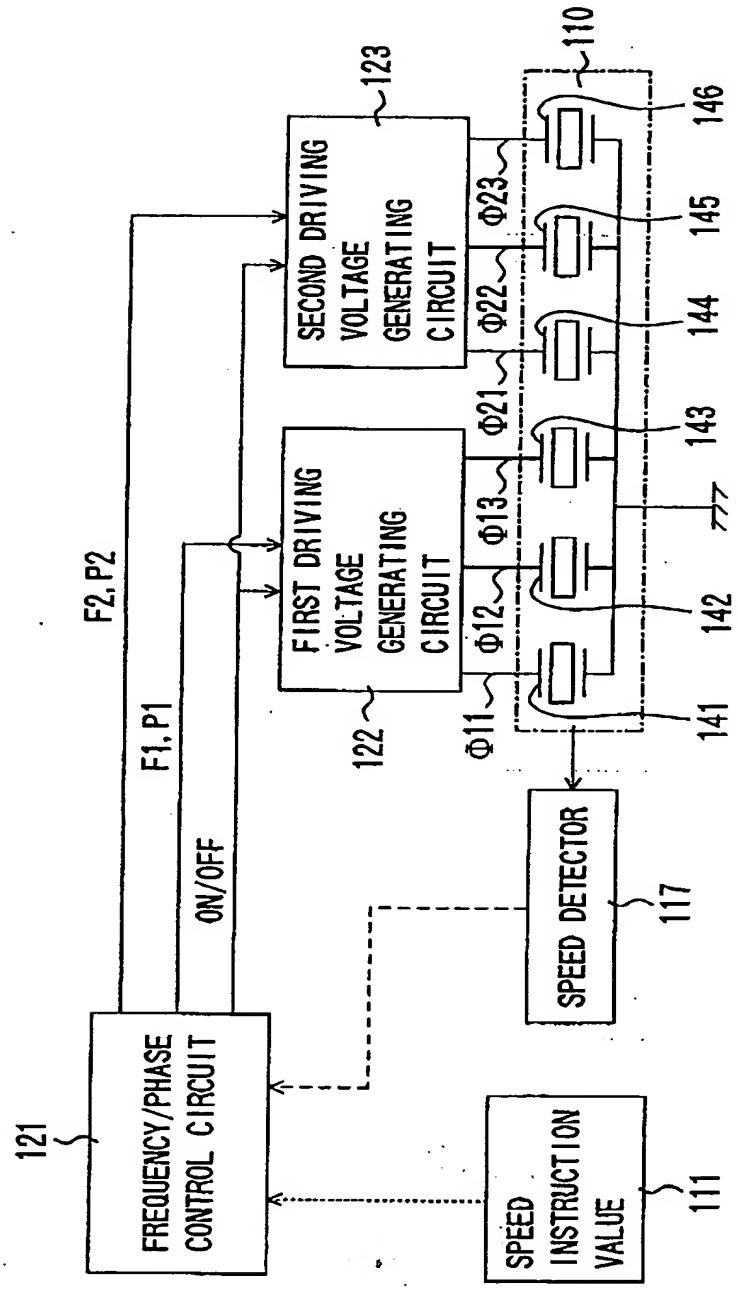

FREQUENCY/PHASE CONTROL CIRCUIT
121
F1, P1
F2, P2
ON/OFF
FIRST DRIVING VOLTAGE GENERATING CIRCUIT
122
SECOND DRIVING VOLTAGE GENERATING CIRCUIT
123
Φ11
Φ12
Φ13
Φ21
Φ22
Φ23
110
141
142
143
144
145
146
SPEED DETECTOR
117
SPEED INSTRUCTION VALUE
111

FIG.22

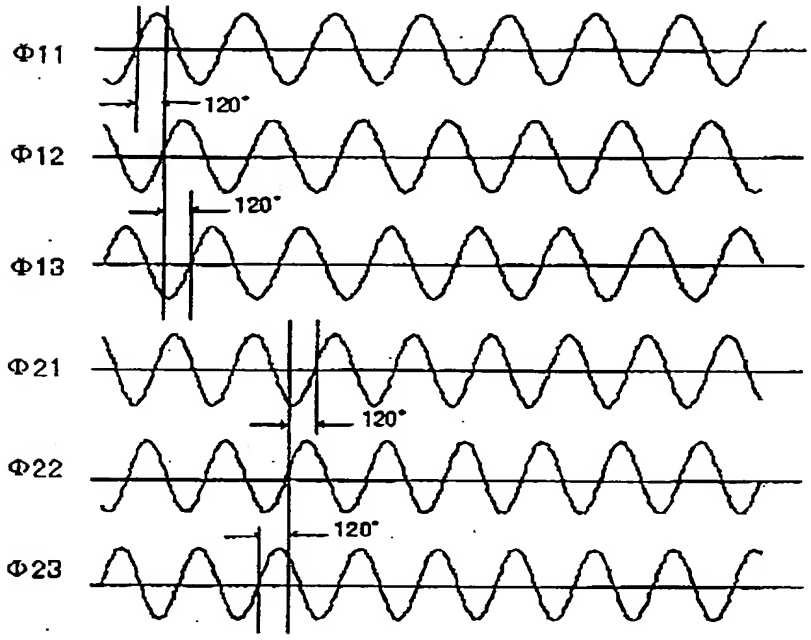


FIG.23

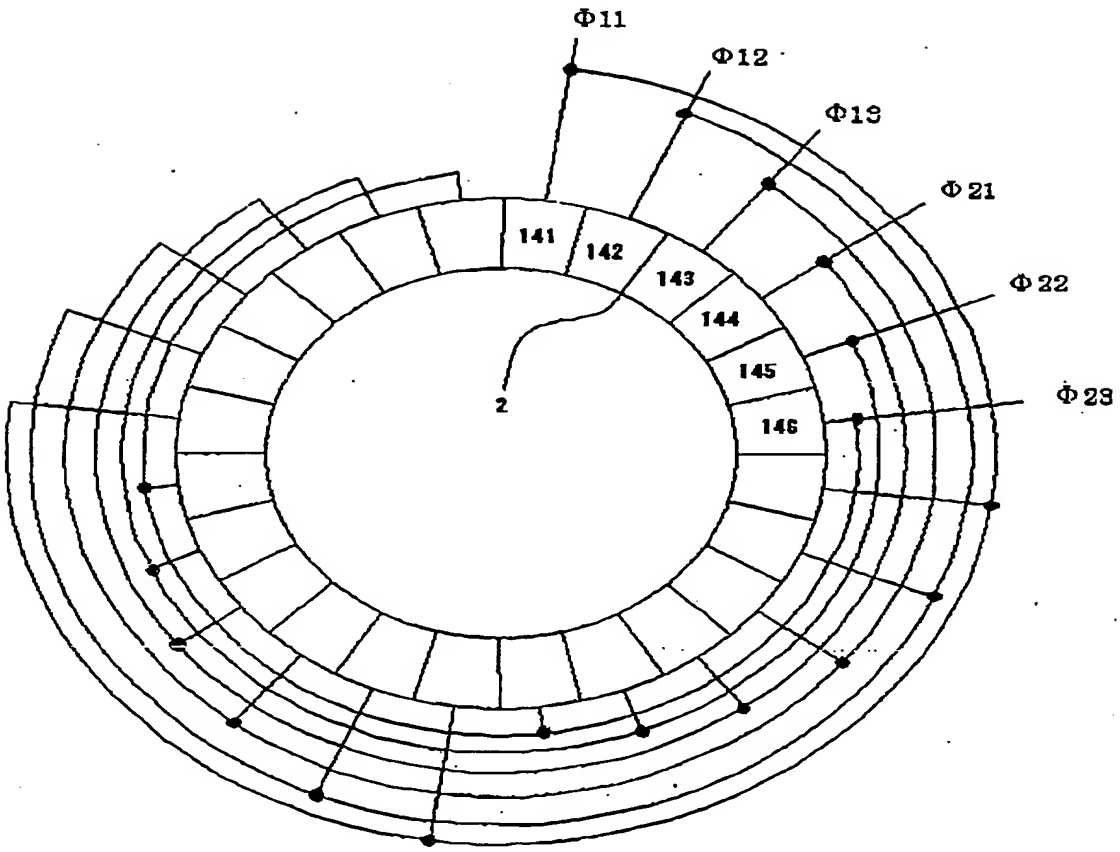


FIG.24

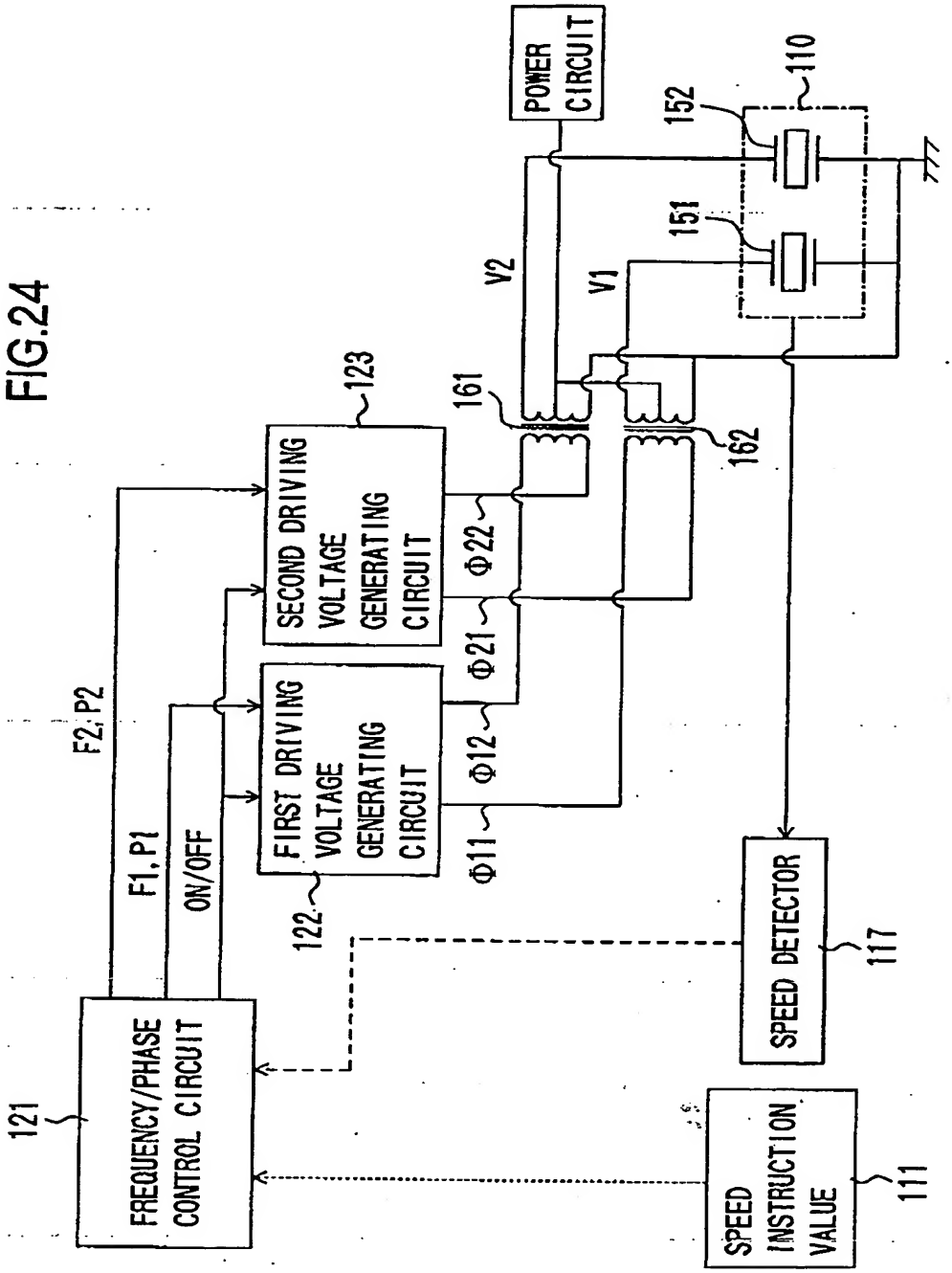

POWER CIRCUIT
110
152
151
V2
V1
161
162
123
SECOND DRIVING VOLTAGE GENERATING CIRCUIT
Φ22
Φ21
FIRST DRIVING VOLTAGE GENERATING CIRCUIT
Φ12
Φ11
122
F2, P2
F1, P1
ON/OFF
FREQUENCY/PHASE CONTROL CIRCUIT
121
SPEED DETECTOR
117
SPEED INSTRUCTION VALUE
111

FIG.25

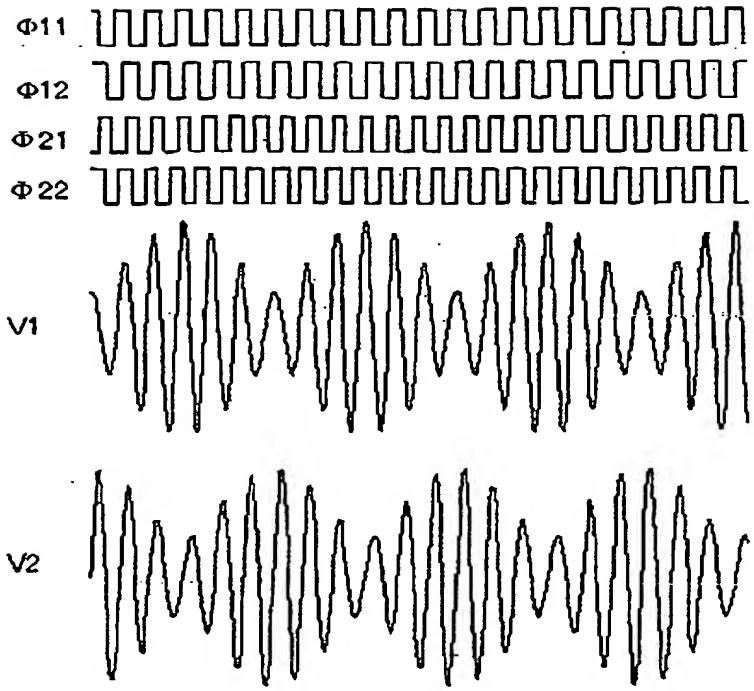


FIG.26

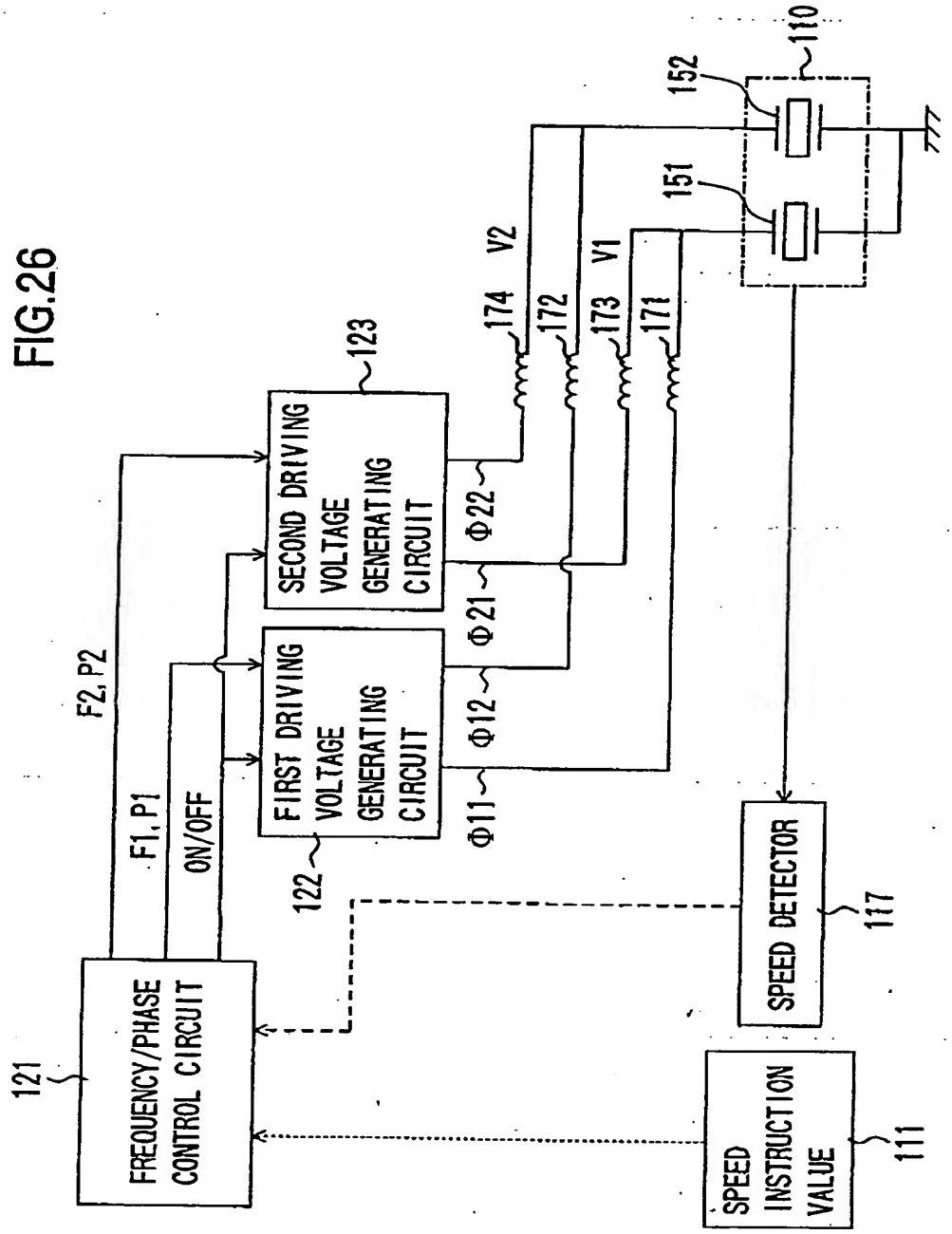

110
152
151
V2
V1
174
172
173
171
123
SECOND DRIVING VOLTAGE GENERATING CIRCUIT
Φ22
Φ21
Φ12
Φ11
122
FIRST DRIVING VOLTAGE GENERATING CIRCUIT
F2, P2
F1, P1
ON/OFF
121
FREQUENCY/PHASE CONTROL CIRCUIT
SPEED DETECTOR
117
SPEED INSTRUCTION VALUE
111

FIG.27

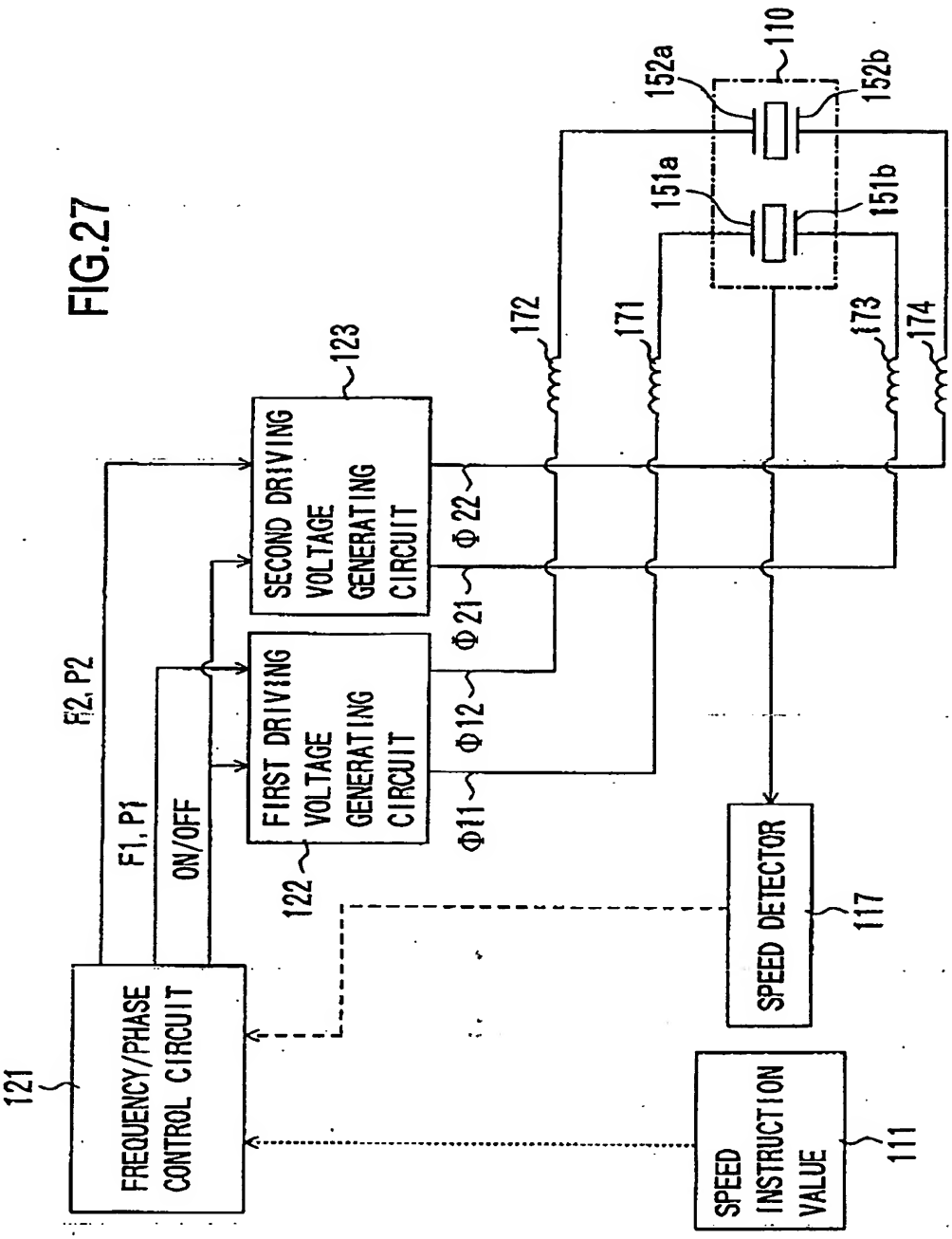

121
FREQUENCY/PHASE CONTROL CIRCUIT
F1, P1
F2, P2
ON/OFF
122
FIRST DRIVING VOLTAGE GENERATING CIRCUIT
123
SECOND DRIVING VOLTAGE GENERATING CIRCUIT
Φ11
Φ12
Φ21
Φ22
171
172
173
174
151a
151b
152a
152b
110
117
SPEED DETECTOR
111
SPEED INSTRUCTION VALUE

FIG.28

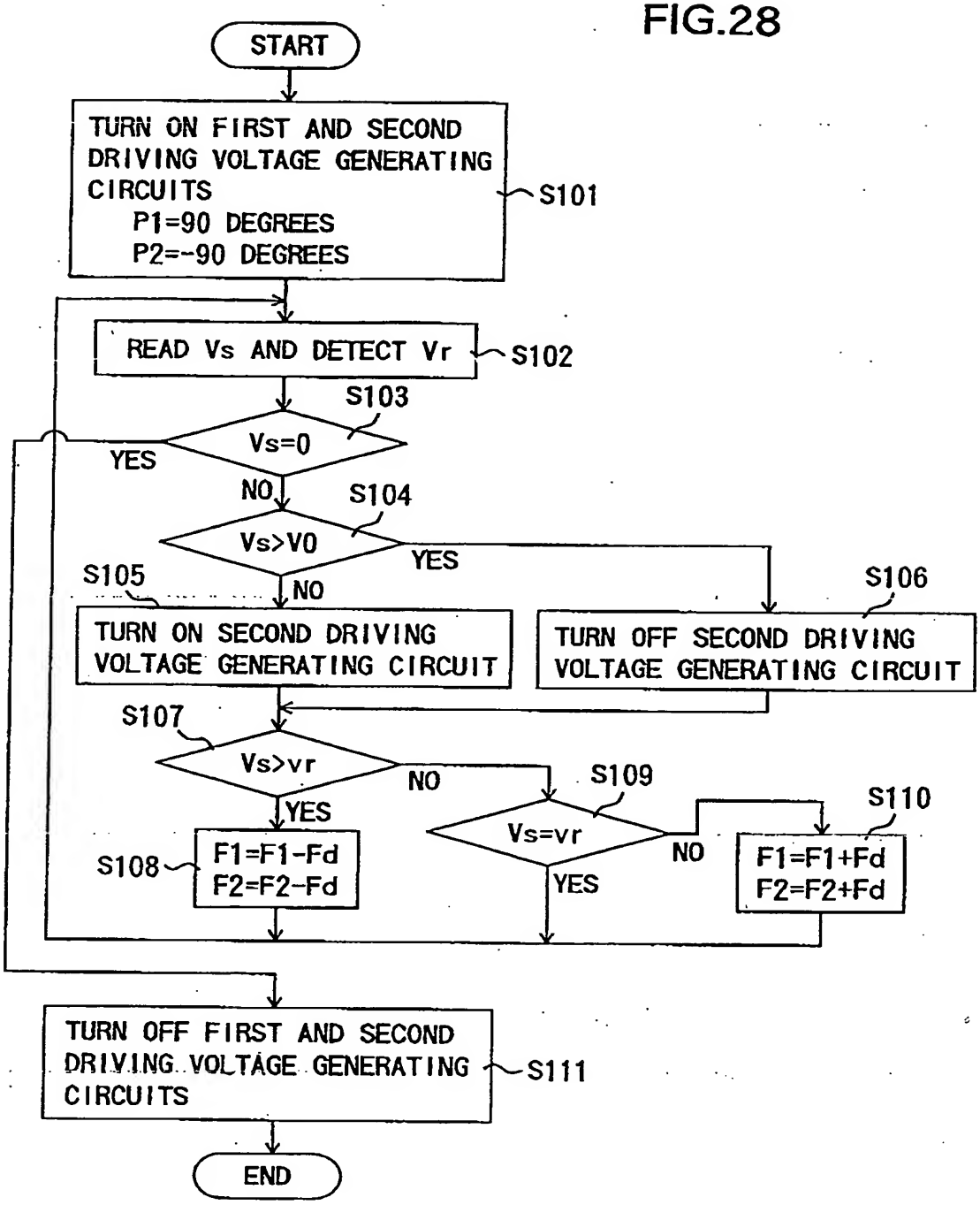

START
TURN ON FIRST AND SECOND DRIVING VOLTAGE GENERATING CIRCUITS
P1=90 DEGREES
P2=-90 DEGREES
S101
READ Vs AND DETECT Vr
S102
S103
Vs=0
YES
NO
S104
Vs>V0
YES
NO
S105
TURN ON SECOND DRIVING VOLTAGE GENERATING CIRCUIT
S106
TURN OFF SECOND DRIVING VOLTAGE GENERATING CIRCUIT
S107
Vs>vr
NO
YES
S108
F1=F1-Fd
F2=F2-Fd
S109
Vs=vr
NO
YES
S110
F1=F1+Fd
F2=F2+Fd
TURN OFF FIRST AND SECOND DRIVING VOLTAGE GENERATING CIRCUITS
S111
END

FIG.29A

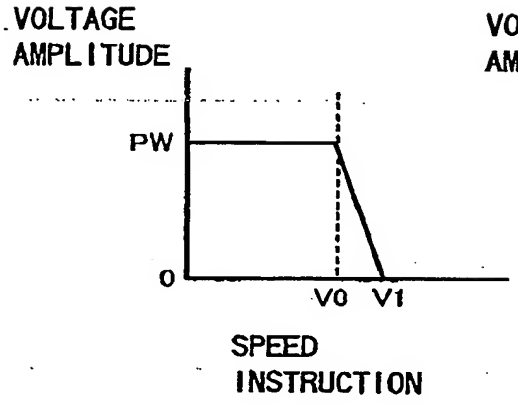


FIG.29B

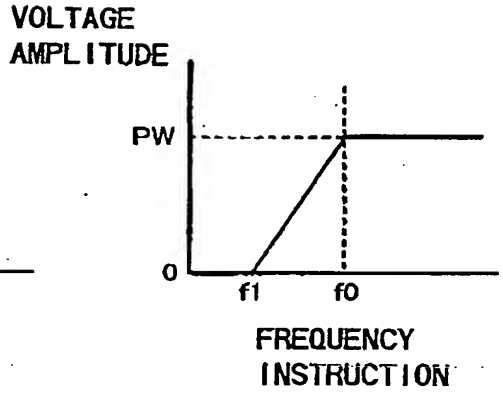


FIG.30

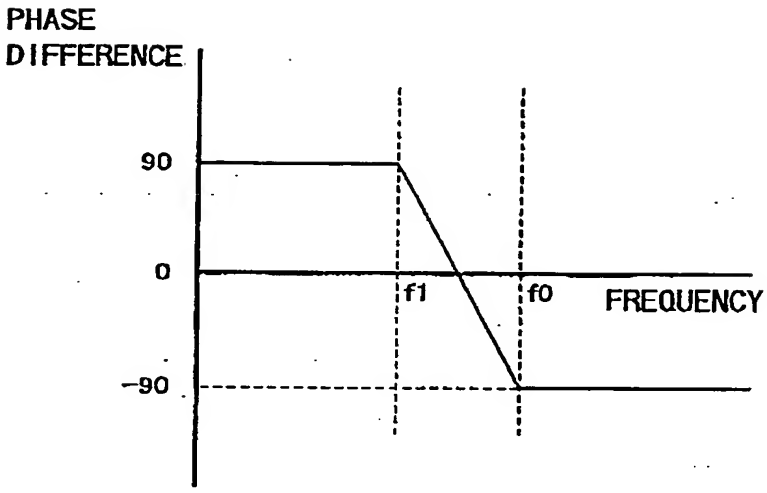


FIG.31

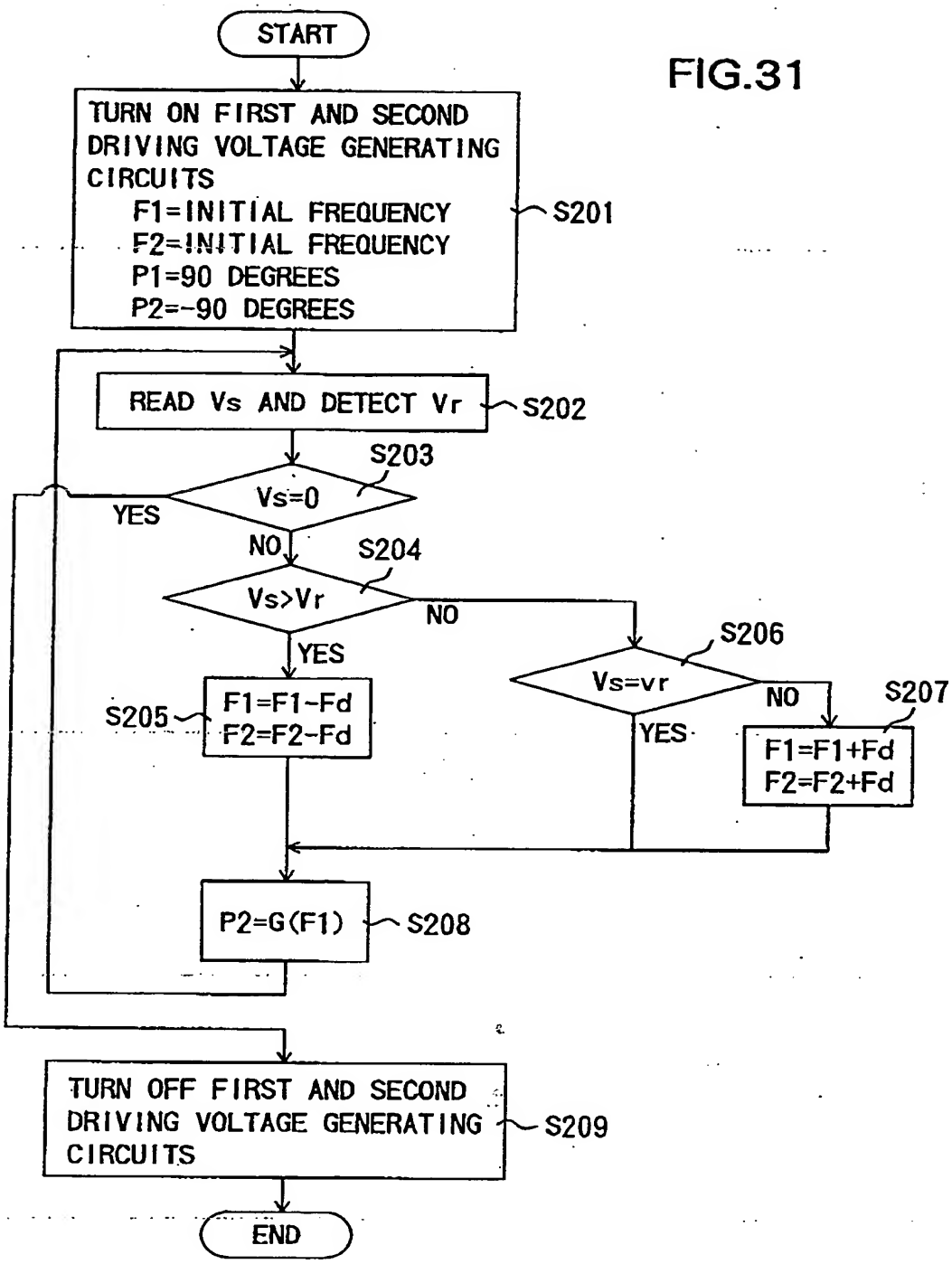

START
TURN ON FIRST AND SECOND DRIVING VOLTAGE GENERATING CIRCUITS
F1=INITIAL FREQUENCY
F2=INITIAL FREQUENCY
P1=90 DEGREES
P2=-90 DEGREES
S201
READ Vs AND DETECT Vr
S202
S203
Vs=0
YES
NO
S204
Vs>Vr
NO
YES
S205
F1=F1-Fd
F2=F2-Fd
S206
Vs=vr
NO
YES
S207
F1=F1+Fd
F2=F2+Fd
P2=G(F1)
S208
TURN OFF FIRST AND SECOND DRIVING VOLTAGE GENERATING CIRCUITS
S209
END

FIG.32

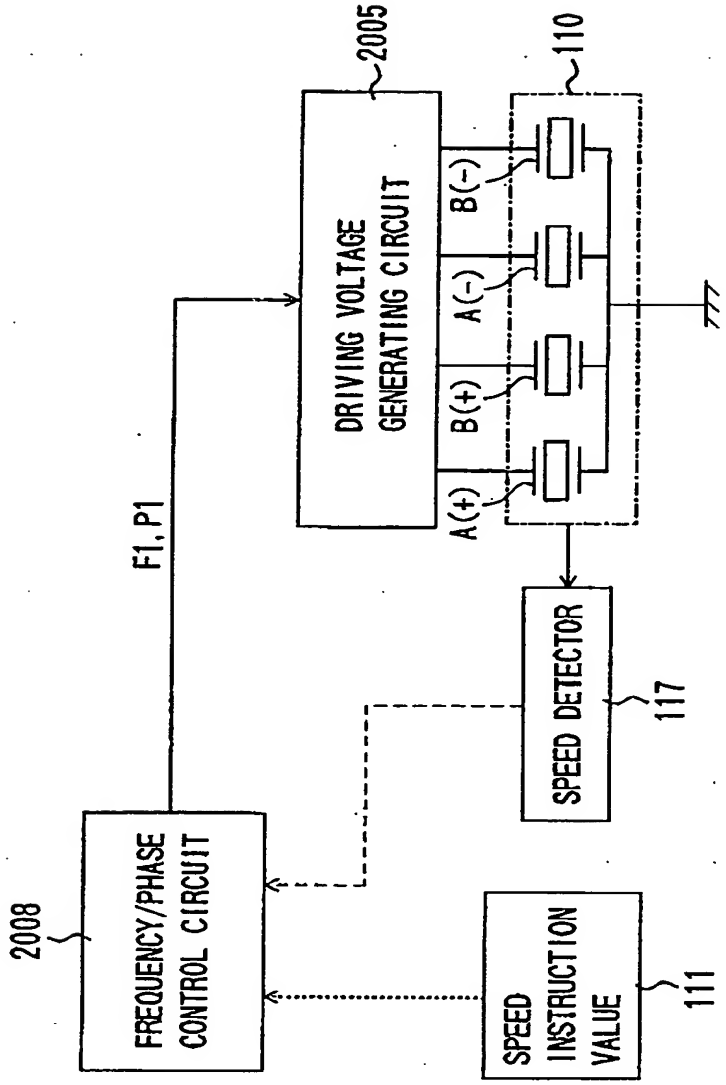

2005
110
DRIVING VOLTAGE GENERATING CIRCUIT
B(-)
A(-)
B(+)
A(+)
F1, P1
SPEED DETECTOR
117
2008
FREQUENCY/PHASE CONTROL CIRCUIT
SPEED INSTRUCTION VALUE
111

FIG.33

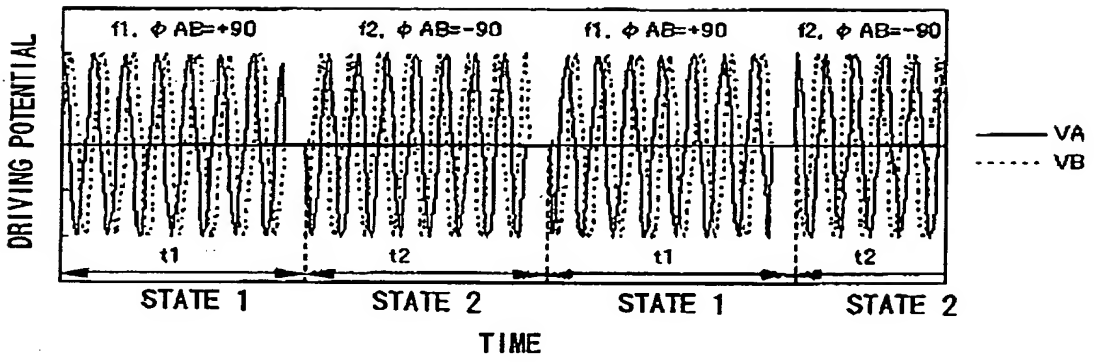

f1. φ AB=+90
f2. φ AB=-90
f1. φ AB=+90
f2. φ AB=-90
DRIVING POTENTIAL
VA
VB
t1
t2
t1
t2
STATE 1
STATE 2
STATE 1
STATE 2
TIME

FIG.34A

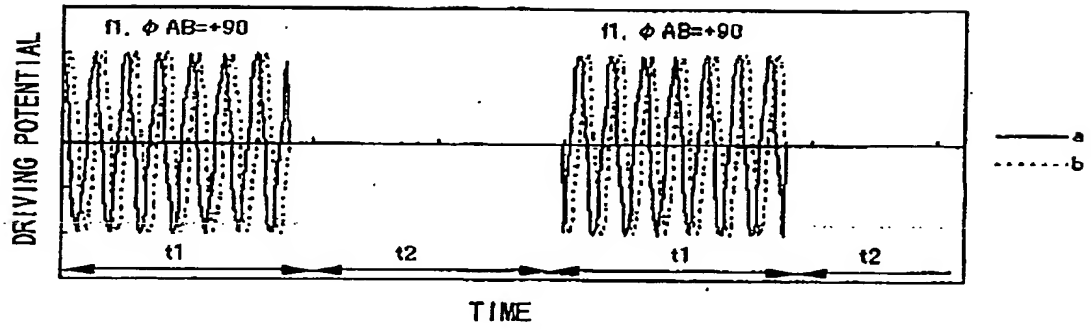


FIG.34B

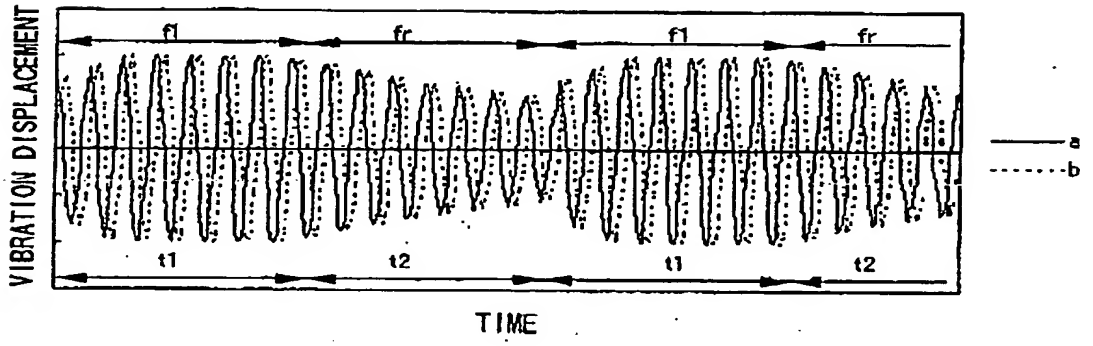


FIG.35A

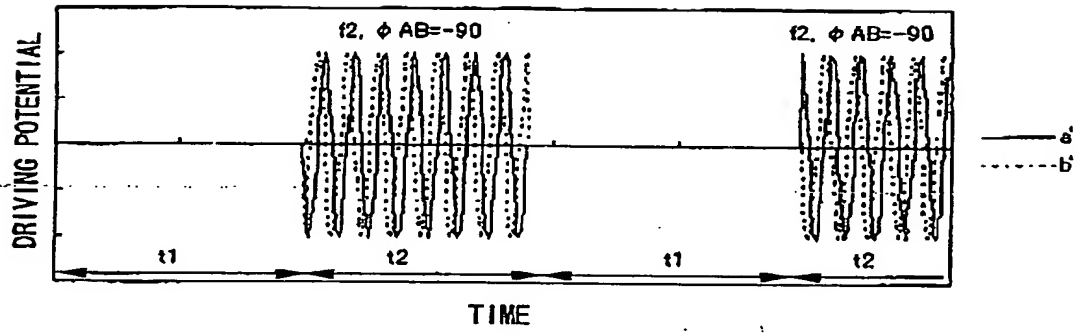


FIG.35B

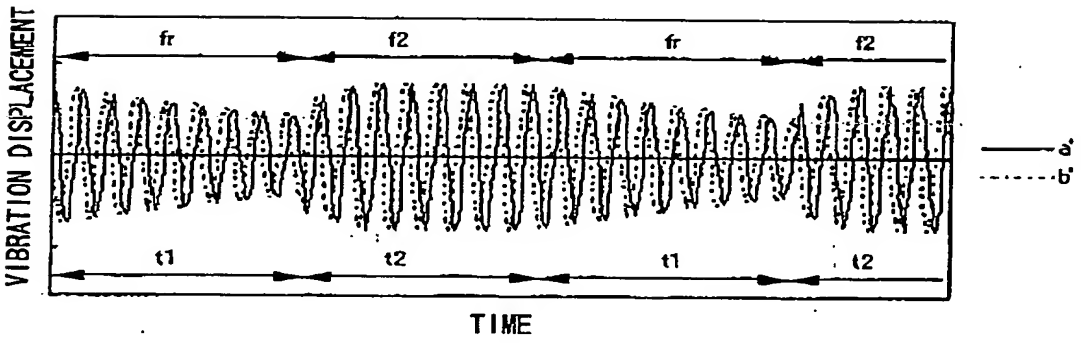


FIG.36

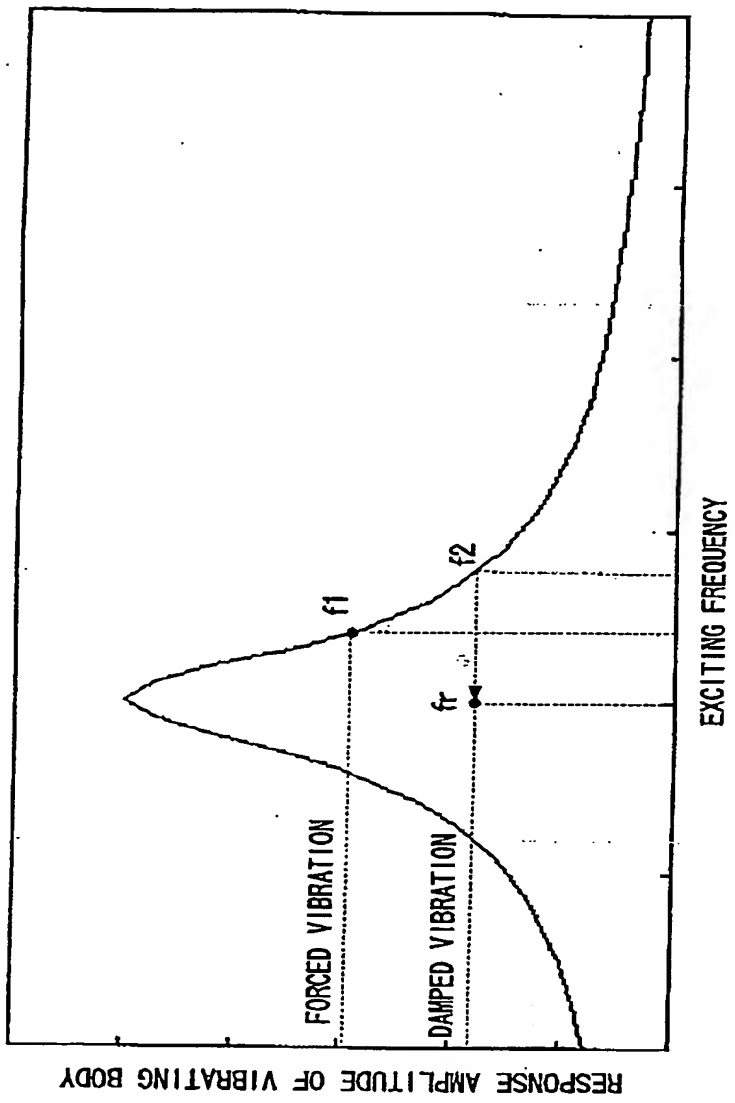

RESPONSE AMPLITUDE OF VIBRATING BODY
EXCITING FREQUENCY
f1
f2
fr
FORCED VIBRATION
DAMPED VIBRATION

FIG.37

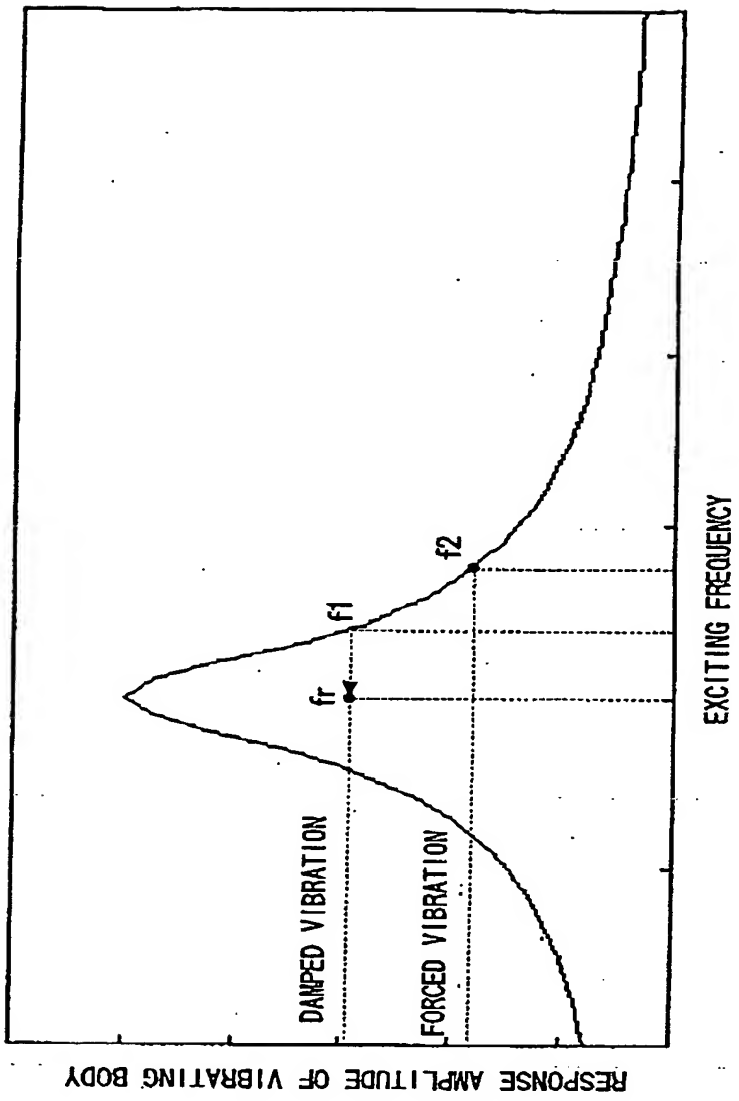

RESPONSE AMPLITUDE OF VIBRATING BODY
EXCITING FREQUENCY
DAMPED VIBRATION
FORCED VIBRATION
fr
f1
f2

FIG.38

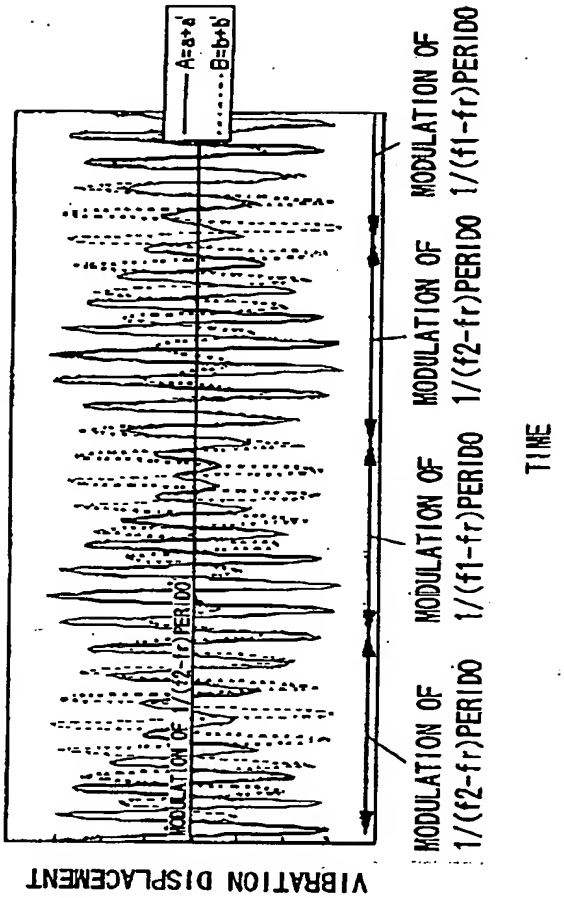

A=a+a'
B=b+b'
MODULATION OF 1/(f2-fr)PERIOD
MODULATION OF 1/(f2-fr)PERIOD
MODULATION OF 1/(f1-fr)PERIOD
MODULATION OF 1/(f1-fr)PERIOD
VIBRATION DISPLACEMENT
TIME

FIG.39

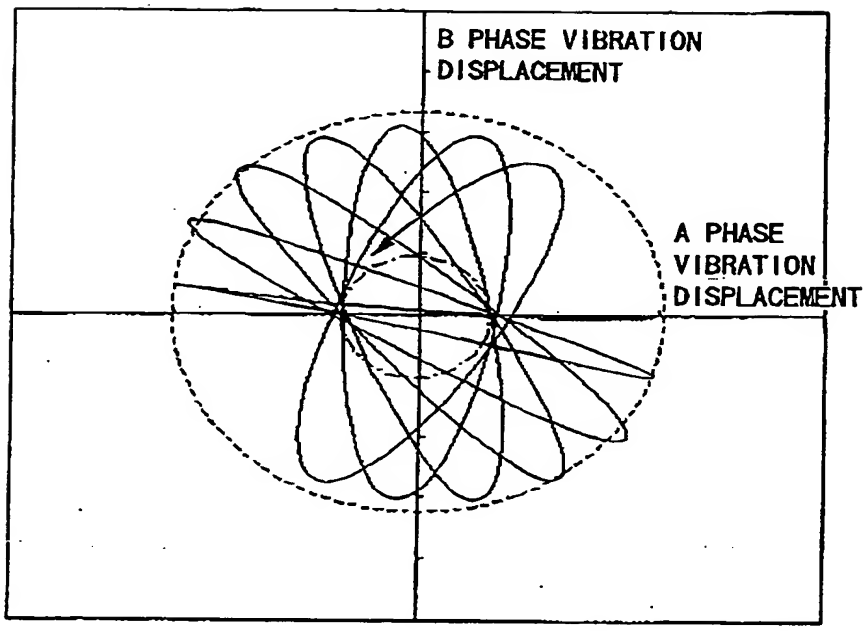

B PHASE VIBRATION
DISPLACEMENT
A PHASE
VIBRATION
DISPLACEMENT

FIG.40

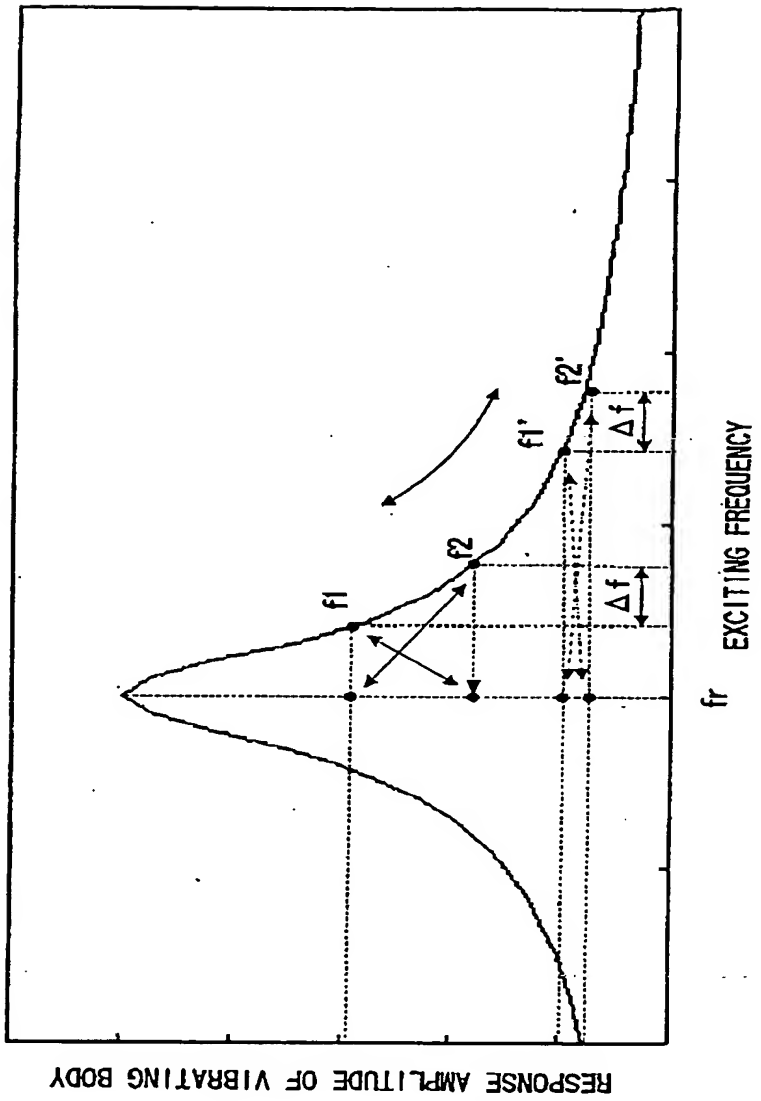

RESPONSE AMPLITUDE OF VIBRATING BODY
EXCITING FREQUENCY
fr
f1
f2
f1'
f2'
Δf
Δf

FIG.41

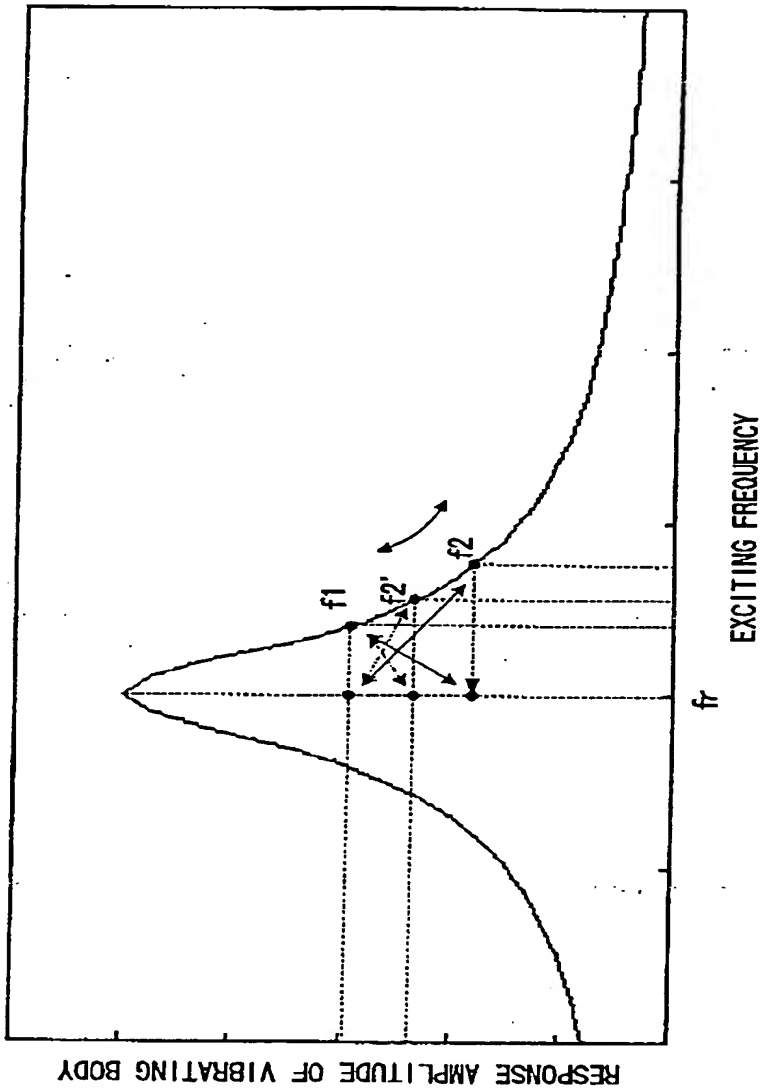

RESPONSE AMPLITUDE OF VIBRATING BODY
EXCITING FREQUENCY
fr
f1
f2'
f2

FIG.42

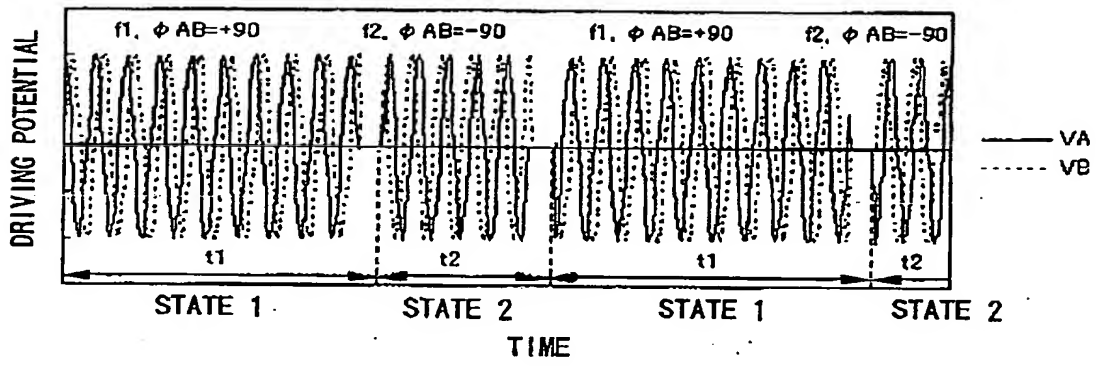

f1, φ AB=+90
f2, φ AB=−90
f1, φ AB=+90
f2, φ AB=−90
DRIVING POTENTIAL
VA
VB
t1
t2
t1
t2
STATE 1
STATE 2
STATE 1
STATE 2
TIME

FIG.43A

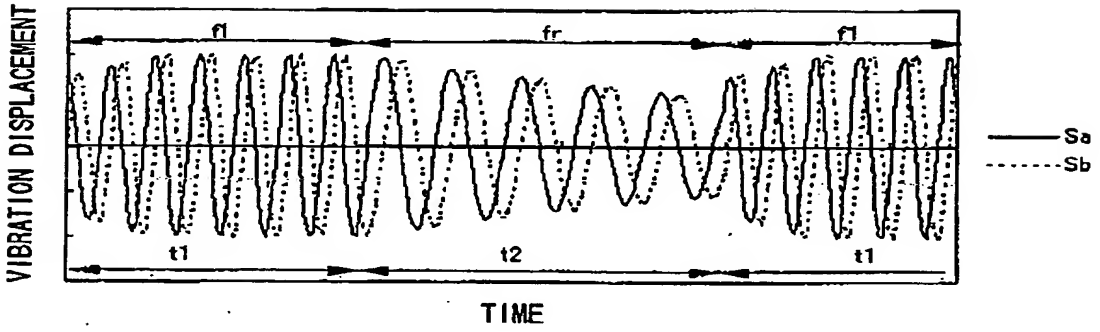


FIG.43B

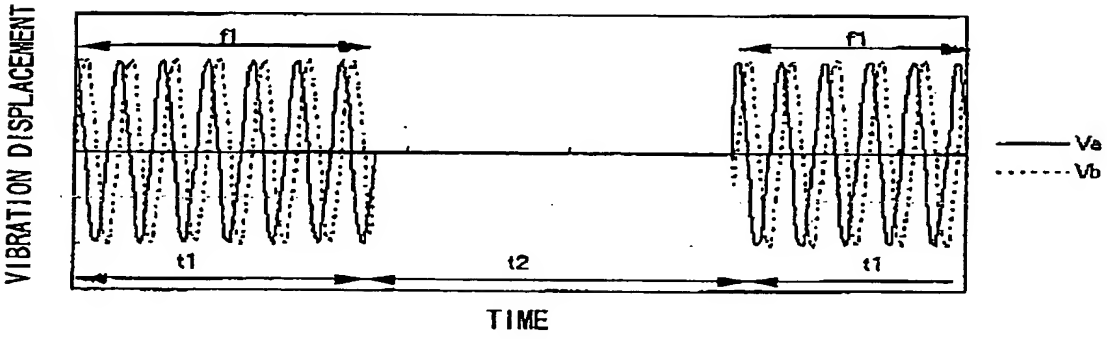


FIG.44
(PRIOR ART)

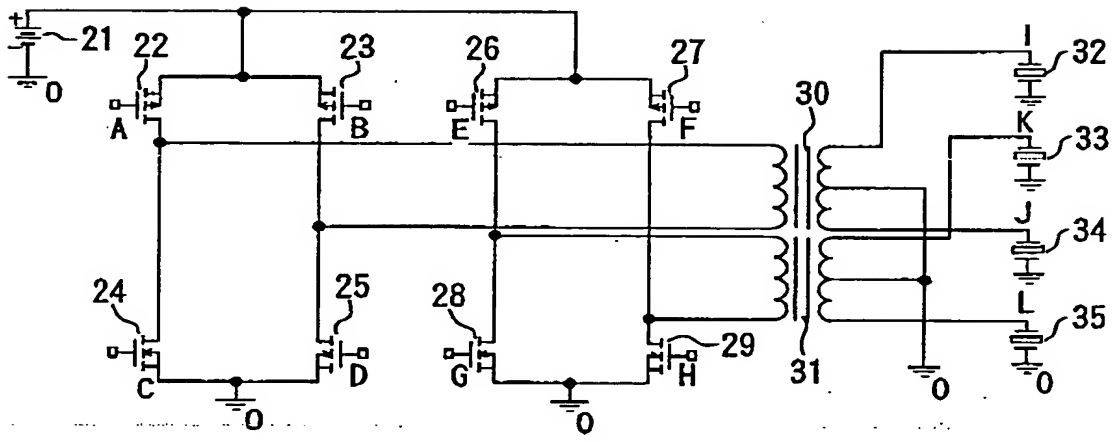


FIG.45A
(PRIOR ART)

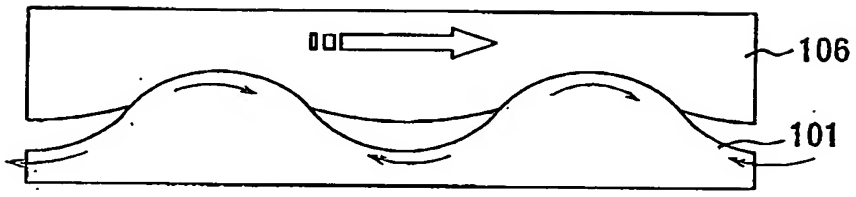


FIG.45B
(PRIOR ART)

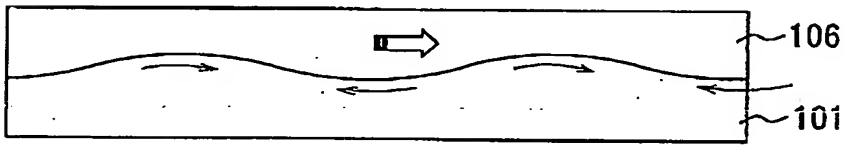
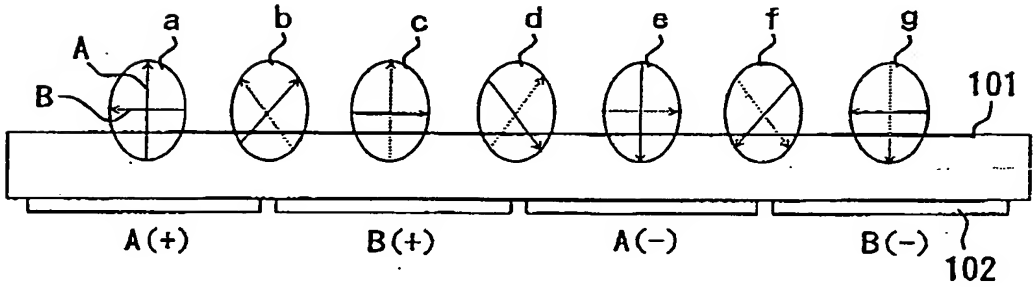



FIG.46
(PRIOR ART)